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10/525,443	02/24/2005	Tadashi Takahashi	5576-177	3864

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MYERS BIGEL SIBLEY & SAJOVEC
PO BOX 37428
RALEIGH, NC 27627

EXAMINER	
BURKHART, ELIZABETH A	
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Please find below and/or attached an Office communication concerning this application or proceeding.

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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/525,443
Filing Date: February 24, 2005
Appellant(s): TAKAHASHI ET AL.

F. Michael Sajovec
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 4/15/2010 and supplemental appeal brief filed 5/20/2010 appealing from the Office action mailed 8/24/2009.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

Takahashi et al, "Preparation of pyrite thin films by atmospheric pressure chemical vapor deposition using FeCl3 and CH3CSNH2", J. Mater. Chem., September 7, 2000, pp. 2346-2348.

Sasaki et al, "Iron pyrite thin film prepared by double source vacuum vapor deposition", Journal of Materials Science Letters 18, 1999, pp. 1193-1195.

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

1. Claims 1, 8, 10, 11, 13, and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takahashi et al and Sasaki et al.

Takahashi teaches a CVD method for preparing a metal sulfide film comprising: vaporizing metal halide ($FeCl_3$) and a thioamide compound (thioacetamide), and reacting the metal halide with the thioamide compound at atmospheric pressure in a heated film forming section to produce a metal sulfide film (pyrite FeS_2) on a substrate. The growth temperature may be 723-823 K (450-550 °C) (Abstract, p. 2346-2347, Table 2). The specification states that trimethyltriazine is formed from thioacetamide at <u>around</u> 400°C (p. 12, lines 3-5) and that a suitable growth temperature may be 350-450°C (p. 9, line 12). Therefore, the method of Takahashi would have inherently formed a triazine compound (trimethyltriazine) since it uses thioacetamide as a precursor within the specified range of growth temperatures.

Takahashi does not teach a growth temperature of 375-425°C.

Sasaki teaches that recently single phase pyrite film (marcasite- and pyrrhotite-free) was prepared by a low pressure MOCVD process. The high partial pressure of sulfur and high temperature can be a critical factor to prepare pure pyrite and once these conditions were satisfied, pure pyrite phase can be prepared by other methods. The Fe/S flux ratio and temperature were adjusted to form a marcasite- and pyrrhotite-free pyrite film. A pure pyrite film may be formed at temperatures higher than 300°C and at a Fe/S flux ratio higher than 6.8 (p. 1193-1195).

It would have been obvious to one of ordinary skill in the art at the time of invention by applicant to adjust the Fe/S flux ratio in the process of Takahashi as suggested by Sasaki in order to form a pure pyrite film at lower temperatures, such as within the claimed range, especially since Takahashi is concerned with forming single phase pyrite and the relationship between the growth temperature and the partial pressure of sulfur can be extrapolated to other known methods of depositing pyrite for solar energy applications as evidenced by Sasaki.

Thus, claims 1, 8, 10, 11, 13, and 15 would have been obvious within the meaning of 35 USC 103 over the combined teachings of Takahashi and Sasaki.

(10) Response to Argument

2. Applicant argues that the method described by Sasaki is a low pressure (in vacuo) vapor deposition method and there is no disclosure or suggestion by Sasaki that the conditions which may be appropriate for preparing pure pyrite by double source vacuum vapor deposition or other in vacuo methods are broadly applicable to any and all methods of vapor deposition, such as atmospheric pressure CVD. The Examiner

disagrees. Takahashi discloses that their atmospheric pressure CVD method for forming pure pyrite is an alternative to low pressure methods (p. 2346, col. 1, 3rd paragraph, Table 1). Further, Sasaki discloses that pure pyrite films were prepared by low pressure CVD and that high partial pressure of sulfur and high temperature is a critical factor to prepare pure pyrite and once these two conditions are met, pure pyrite can be prepared by other methods (p. 1193, col. 1, last full paragraph). It would have been obvious to one of ordinary skill in the art to apply these two conditions (i.e. high sulfur partial pressure and high temperature) to the atmospheric pressure CVD process of Takahashi in order to form pure pyrite at lower temperatures since the “high temperature” condition of Sasaki includes temperatures of above 300°C. One would reasonably expect these conditions to be satisfactory for preparing pure pyrite in an atmospheric pressure method since Sasaki does not disclose that the pressure is a critical factor, but rather just the high partial pressure of sulfur and the high temperature are critical. The high partial pressure of sulfur would be easily met in the process of Takahashi since Takahashi discloses separate iron and sulfur sources (i.e. $FeCl_3$ for iron and CH_3CSNH_2 for sulfur).

3. Applicant argues that the disclosures of Takahashi was published after the disclosures of Sasaki and that Takahashi indicates that conditions for using atmospheric pressure CVD to prepare pure pyrite film were not generally within the grasp or known to one of ordinary skill in the art at the time of the disclosures of Sasaki and indicate that the disclosures of Sasaki were not considered to be applicable to vapor deposition methods not performed in vacuo. The Examiner disagrees. The fact that Takahashi was

published after Sasaki is irrelevant. At the time of invention by applicant, one of ordinary skill in the art would have reasonably concluded that the critical factors of Sasaki, such as the high partial pressure of sulfur and high temperature, could be extrapolated to the atmospheric CVD process of Takahashi since Sasaki does not disclose any criticality for low pressure and discloses that once the critical factors are satisfied, pure pyrite may be formed by other methods. Further, it would have been easy to meet the high partial pressure of sulfur in the Takahashi process since Takahashi uses a separate sulfur source. Further, Takahashi does not discourage the skilled person from lowering the temperature for forming pure pyrite, but rather discloses that the temperature should not be too high since pure pyrite would no longer be formed (Fig. 5).

4. Applicant argues that Sasaki discloses that there is a problem with formation of marcasite when preparing films by low pressure MOCVD at temperatures below 450°C and that while Sasaki discloses preparing pure pyrite by double source vacuum vapor deposition at temperatures above 300°C, Sasaki clearly does not suggest that such conditions are suitable for other methods of depositions, such as atmospheric pressure CVD. The Examiner disagrees. Sasaki discloses that pure pyrite films were prepared by low pressure CVD and that the problem of marcasite formation was solved by using high partial pressure of sulfur and high temperature, which are critical factors to prepare pure pyrite, and once these critical factors are met, pure pyrite can be prepared by other methods (p. 1193, col. 1, last full paragraph). As discussed above, it would have been obvious to extrapolate the critical factors of Sasaki, such as the high partial pressure of sulfur and high temperature, to the atmospheric pressure CVD process of Takahashi

since Sasaki does not disclose any criticality for low pressure and discloses that once the critical factors are satisfied, pure pyrite may be formed by other methods.

5. Applicant argues that the reactants of Sasaki (i.e. elemental iron and sulfur) are different from the reactants of the present invention (i.e. metal halide and thioamide, also the same as Takahashi) and the Fe/S ratio as disclosed by Sasaki is not directly applicable or could be extrapolated to the reactants of the present invention. The Examiner disagrees. Although Takahashi, along with the present invention, discloses different reactants than Sasaki, both disclose a separate iron source and a separate sulfur source and thus the Fe/S ratio would be easily extrapolated to the process of Takahashi since one could simply control the amount of each reactant evaporated from the source boats.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

/Elizabeth Burkhart/
Examiner, Art Unit 1715

Conferees:

/Timothy H Meeks/

Supervisory Patent Examiner, Art Unit 1715

/Christopher A. Fiorilla/

Chris Fiorilla

Supervisory Patent Examiner, Art Unit 1700